The Hong Kong University of Science and Technology
Department of Civil and Environmental Engineering
Spring 22-23

Rubric Title of course Instructor Teaching assistant	CIVL 2120 Mechanics of Materials Tim Tse / Thomas Hu CAO Siqi, LIU Junle, WANG Jiayao, ZHOU Lei, FU Yunfei, LI Yutong
Prerequisites Credits	CIVL 2110 (Statics) or equivalent 3
Textbook(s) and/or other materials	Beer, Johnston, DeWolf & Mazurek: *Mechanics of Materials (8th Edition in SI units)*, McGraw-Hill
Course objectives	1. Acquire a basic understanding of stress, strain and their relations based on linear elasticity 2. Acquire basic skills for stress and deformation calculations for axially loaded members and torsional bars 3. Develop the ability to produce shear and moment diagrams 4. Acquire basic skills for calculating normal and shear stresses on beam cross-sections 5. Acquire basic knowledge of choosing appropriate beam cross-sections for given loading conditions 6. Acquire basic skills for determining beam deflection (e.g., moment-area method, superposition, ODE solving, etc.) 7. Acquire a basic understanding of using Mohr's circle to find principal stresses and angles
Topics	1. Introduction: statics review 2. Stress and strain; axial loading 3. Torsion 4. Review on shear and bending moment in beams 5. Pure bending 6. Analysis and design of beams for bending 7. Shearing stresses in beams 8. Transformation of stress and strain 9. Deflection of beams
Compute usage	N/A
Lab projects	No lab work is required
Class/lab schedule	Two 80-minute lectures with an additional 50-minute tutorial per week
Contribution to the professional component	100% Engineering topics
Intended Learning Outcomes (ILOs) of	On successful completion of this course, students are expected to be able to:

this course	I. Examine the key principles used in the analysis of stress, strain and deformation, properties of engineering materials and safety factors. II. Apply physical models to perform stress calculations and determine deflection, including thermal effects, in structural members such as axially loaded bars, torsional rods and beams. III. Analyze and design simple structural members and determinate systems such as trusses, torsional members and beams on foundations.
Relationship to the program objective	*PEO1: Provide students with professional skills in the design, construction and management of the civil infrastructure, as well as an awareness of environmental sustainability.* - Students will develop an ability to perform analysis and design of engineering structures (ILO # II, III) *PEO3: Challenge students with research-type and open-ended design problems to stimulate self-learning and innovative problem solving skills.* - Various teaching innovations as compu-graphical methods and powerful CAS calculators are utilized in this class. These allow students to develop an ability to visualize and solve problems in more effective and efficient ways, and to perform further explorations on their own by changing parameter values (ILO I, II, and III) *PEO4: Expose students to real world engineering projects as well as cutting edge research to improve their understanding of the profession and technological advancements that can improve current practice* - Realistic examples are provided, allowing students to apply and appreciate the importance of stress analysis in real-life situations. (ILO # II, III)
Relationship to program outcome	*PO1: Acquire fundamental knowledge in mathematics and science on which civil and environmental engineering research and practice are based* - Students will apply Newton's laws and associated engineering mathematics throughout this course (ILO #I, II, and III) *PO2: Understand fundamental principles of engineering science relevant to civil engineering disciplines* - Students learn various mechanics principles such as superposition, symmetry, energy methods, Saint-Venant's principle, etc. (ILO #I, II, and III) *PO4: Acquire an ability to apply modern engineering and IT tools effectively and efficiently for engineering analysis, design and communication* - Students will learn efficient methods utilizing graphing calculators with CAS (Computer Algebra Systems) to solve mechanics problems (ILO #II, III) *PO5: Develop an ability to identify and formulate civil engineering problems, and propose feasible solutions with an appreciation of their underlying assumptions, uncertainties, constraints, and technical limitations* - Students will apply the theories learned to model simple inter-connected structural systems and obtain solutions (ILO #III)

	PO6: Develop technical competency to design civil engineering components and systems, with an understanding of the principles behind the design methodologies - Students will develop an ability to select the proper size and shape of structural members to meet design limits on stress, deflection, weight, etc. (ILO #I, II, and III) *PO11: Instill a deep sense of professional responsibilities and the importance of ethical and societal considerations, including public health, safety, environmental conservation, welfare etc.* - Students will develop an ability to analyze safety requirements of structural systems and understand the importance of preventing structural failure (ILO #I, II, and III)
Assessment of Outcomes	1. Assignments are given to assess student understanding of the topics during the learning process (ILO #I, II and III), 20% 2. Mid-term and final examinations are conducted to assess student understanding of the topics (ILO #I, II, and III), 80%
Prepared by	Tim Tse / Thomas Hu
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